PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-110056
(43)Date of publication of application : 20.04.2001

(51)Int.Cl. G11B 7/0045

(21)Application number : 11-285820
(22)Date of filing : 06.10.1999

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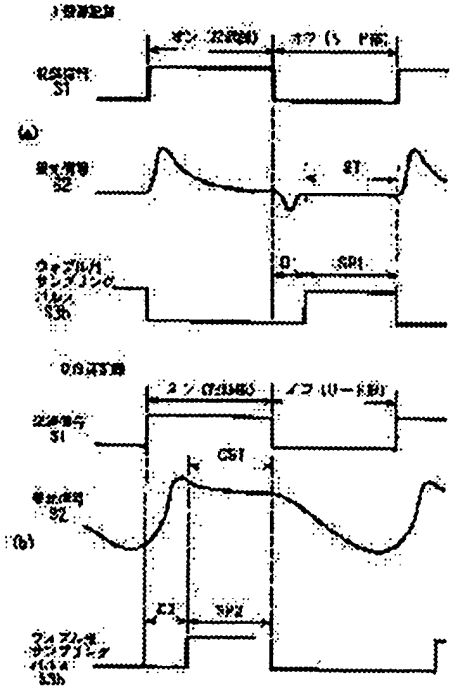
(54) OPTICAL DISK RECORDING METHOD AND DEVICE THEREFOR

(57)Abstract:
PROBLEM TO BE SOLVED: To make recordable an optical disk without disturbing a wobble signal detective operation even at a high-fold speed recording time.
SOLUTION: In this optical disk recording method by which pits are formed on a land by irradiating the optical disk with light beams for recording, at the recording speed lower than a prescribed recording speed, the sample and hold of a light receiving signal for detecting a wobble signal is performed when a recording signal is powered off, and at the recording speed larger than the prescribed recording speed, the sample and hold is performed when the recording signal is powered on, so that the wobble detection is performed always at an excellent C/N regardless of the recording speed.



LEGAL STATUS

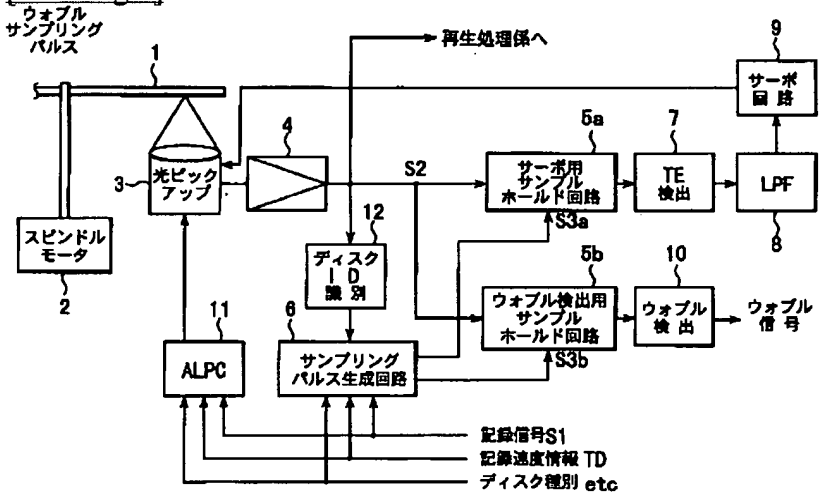
[Date of request for examination]	13.07.2001
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3292184
[Date of registration]	29.03.2002
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's	

* NOTICES *

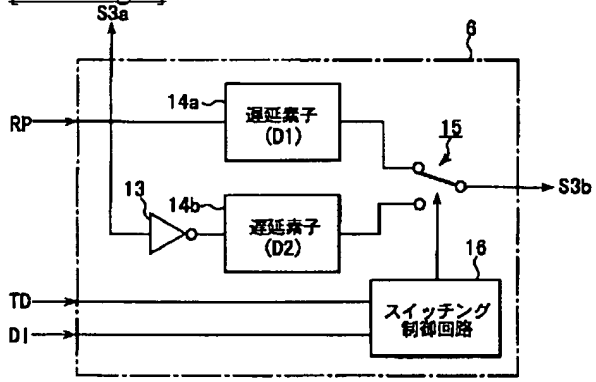
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

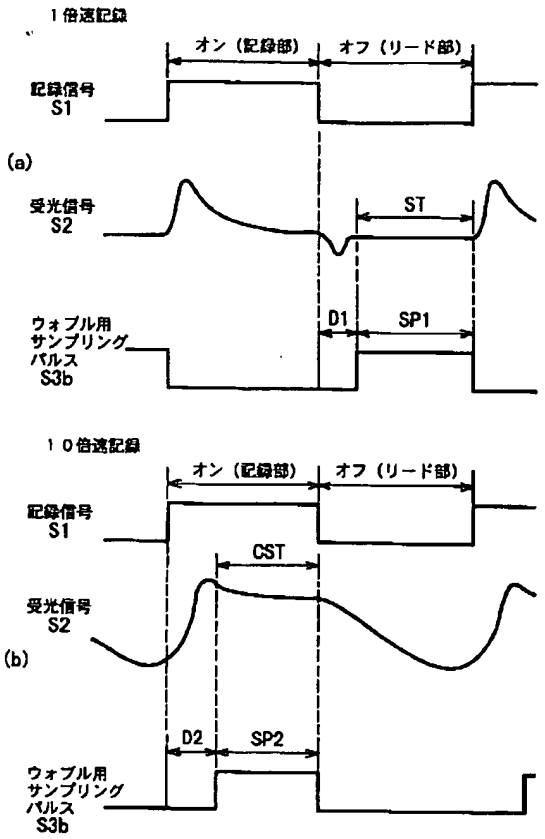
[Drawing 1]



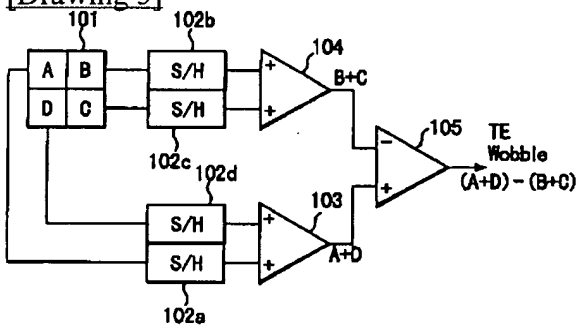
[Drawing 2]



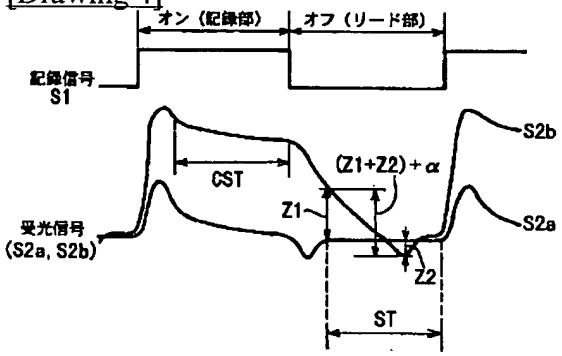
[Drawing 3]



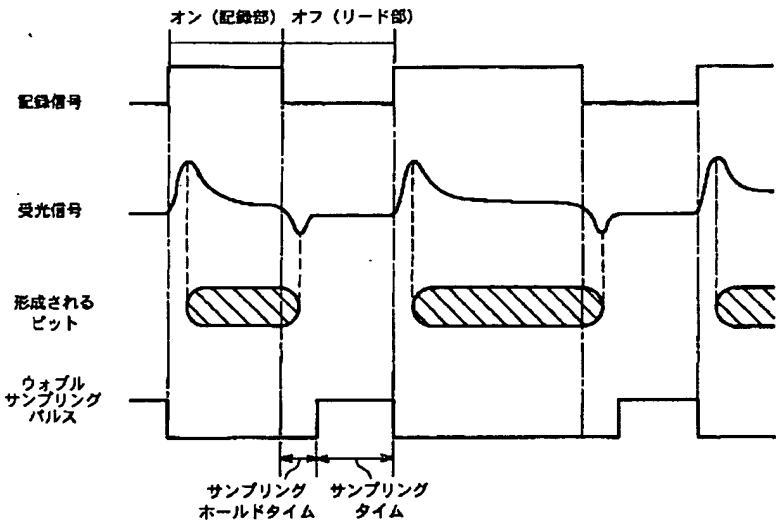
[Drawing 5]



[Drawing 4]



[Drawing 6]



[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the wobble signal detection at the time of record especially about the optical disk record approach and equipment which record information by optical power to an optical disk like CD-R, CD-RW, CD-WO, and MD and DVD.
[0002]
[Description of the Prior Art] The guide rail to which rewriting mold optical disks, such as write once optical disks, such as CD-R, and CD-RW, are called a groove (or PURIGURUBU) forms a pit on a truck by being formed beforehand and irradiating a laser beam along the truck which consists of lands which are the parts between this groove or groove, and groove to a revolving optical disk, and information is recorded. Moreover, absolute time information (ATIP information) is embedded by making a truck slot lie in a zigzag line (wobble) at the groove of this kind of optical disk. Usually, record/playback control is performed based on the ATIP information which reproduces this wobble signal and is acquired with a tracking servo.
[0003] As shown in drawing 5 , a tracking error signal (TE signal) and a wobble signal are detected by processing the output of the photodetector for location detection of an optical pickup, and the photodetector for location detection is usually constituted by the quadrisection photodetector 101. The light-receiving side where the light-receiving side where (A+D) (B+C) was divided into radial [of an optical disk] among four light-receiving sides A, B, C, and D of the quadrisection photodetector 101 was formed, and (A+B) (C+D) was divided in the direction of a truck of an optical disk is formed. Sample hold of the light-receiving signal acquired by receiving the reflected light from an optical disk in respect of [A, B, C, and D] light-receiving, respectively is carried out in sample hold circuits 102a, 102b, 102c, and 102d, respectively. The light-receiving signal of the light-receiving sides B and C with which the light-receiving signal of the light-receiving sides A and D by which sample hold was carried out in sample hold circuits 102a and 102d was added with the adder 103, and sample hold was carried out in sample hold circuits 102b and 102c is added with an adder 104. Moreover, the difference [(A+D)-(B+C)] of an adder 103,104 is called for by the subtractor 105. Since it is in phase to the light-receiving sides A, B, C, and D, and is detected in them and (A+D) and (B+C) serve as a signal of opposition to the radial location of the beam spot to a land, this can be used for the EFM signal modulated by the existence of a pit as TE signal or a signal for wobble detection.
[0004] Drawing 6 is the record signal at the time of recording with a 4X recording rate, a light-receiving signal, the pit formed, and drawing showing the relation of the sampling pulse for wobble signal detection. As shown in this drawing, the record signal is divided when it is a time (Records Department) of the power being ON, and OFF (lead section). The level of a light-receiving signal It originates in change of the reflection factor like a record pit formation fault, immediately after a record signal becomes power-on, it has a peak, it falls gradually with pit formation, and if a record signal becomes power-off, it is the wave pattern which becomes a flat mostly and is stabilized in a part of the period. Formation of a pit begins from the time of the level of a light-receiving signal becoming peak value, and after a record signal becomes power-off and carrying out for a while, it is finished. At this time, after, as for the sampling pulse for wobble detection, a record signal becomes off, sample hold of the fixed period is carried out. This is because C/N of a wobble signal will become good if the sampling for wobble detection is carried out in the period by which the light-receiving signal was stabilized.

[0005]
[Problem(s) to be Solved by the Invention] However, according to such a conventional wobble detecting method, when recording with a recording rate still more nearly high-speed than it, for example, 12X, the wave pattern of a light-receiving signal changes a lot, and the stable period between record signal power-off becomes very short. Since it is necessary to take such the reason nil why it is longer in order to perform positive pit formation that what was nT in 8X about chart lasting time become a high speed like [in 12X] T (n+0.4) in the high-speed record to the 1st, it is because record power becomes large relatively compared with low-speed record, so the provincial accent of a light-receiving signal becomes large in high-speed record. Therefore, in high-speed record, since the sampling period for wobble detection becomes extremely short, C/N of a wobble signal will get worse.
[0006] This invention was made in view of such a trouble, and aims at offering the optical disk record approach and equipment which can perform wobble detection by always good C/N irrespective of a recording rate.
[0007]
[Means for Solving the Problem] While the optical disk record approach concerning this invention irradiates the light beam for information record to an optical disk based on a record signal and forms the pit of predetermined die length in a land Receive light by the photo detector which has the light-receiving side divided into radial [of said optical disk] in the reflected light from the pit formation section and the pit agenesis section of said optical disk at the time of record, and sample hold of the light-receiving signal is carried out. In the record approach of an optical disk of performing detection of a tracking servo and a wobble signal based on this optical disk radial light-receiving signal balance by which sample hold was carried out In a recording rate lower than a predetermined recording rate, sample hold of said light-receiving signal for detection of said wobble signal is performed, when said record signal is power-off. In the recording rate more than a predetermined recording rate, it is characterized by performing this sample hold, when said record signal is power-on.
[0008] Moreover, while the optical disk recording apparatus concerning this invention irradiates the light beam for recording a pit on the land of an optical disk based on a record signal The optical pickup which receives light by the photo detector which has the light-receiving side divided into radial [of said optical disk] in the reflected light from said optical disk, and outputs the light-receiving signal in respect of [said / each] light-receiving, While processing said record signal and generating the 1st sampling pulse Carry out delay processing of said record signal, and when a recording rate is lower than a predetermined rate, said record signal is turned on within the period of power-off. The sampling pulse generation circuit which generates the 2nd sampling pulse from which said record signal is turned on within the period of power-on when a recording rate is said more than predetermined rate, The 1st sample hold circuit which carries out sample hold of the light-receiving signal from said optical pickup based on said 1st sampling pulse, The tracking error detector which generates a tracking error signal in said 1st sample hold circuit based on the radial balance of said optical disk of the signal by which sample hold was carried out, The servo circuit which carries out tracking control of said optical pickup based on the tracking error signal from said tracking error detector, The 2nd sample hold circuit which carries out sample hold of the light-receiving signal from said optical pickup based on said 2nd sampling pulse, It is characterized by having the wobble detector which detects a wobble signal in said 2nd sample hold circuit based on the radial balance of said optical disk of the signal by which sample hold was carried out.
[0009] usually, a pigment system optical disk -- receiving -- a light beam -- irradiating (a record signal being power-on) -- since the pit is not formed immediately after exposure initiation, the reflection factor of an optical disk is a high level highly, but since [to which is resembled, and is followed and a reflection factor falls gradually] the pit is formed with the time constant, the level of a light-receiving signal falls similarly and is stabilized by the level of the reflective signal (light-receiving signal). and the exposure of a light beam -- there is nothing (a record signal is power-off) -- the period by which the level of a light-receiving signal is mostly stabilized for a flat is made. However, this is being able to say, when a recording rate's is lower than a predetermined rate. For this reason, in record at a rate lower than a predetermined recording rate, in this invention, the sampling for wobble signal detection is performed at the period when the level of a light-receiving signal is stabilized by the record signal within the period of power-off. However, the more it becomes quick so that a recording rate may be 10X, in order that it is necessary to make high the rate of a power-on period to the power-off period of a record signal in order to form a pit certainly and the standup and falling of a

light-receiving signal may become blunt the more in addition (the level of an output not falling and a bottom peak be overdue), the period by which the level of a light-receiving signal is stabilized within a record signal power-off period becomes short, and the sampling time is shortened. Then, in this invention, when a recording rate is more than a predetermined rate, it is made to perform the sampling for wobble detection at a record period. Thereby, the level of the light-receiving signal itself also becomes large, and a wobble signal can be detected by always good C/N irrespective of a recording rate as a whole.
[0010] Furthermore, if it is made to change the sample hold timing of the light-receiving signal for wobble signal detection accommodative bordering on a predetermined recording rate based on the class and recording rate of an optical disk, even if the class and recording rate of an optical disk differ from each other, it will become possible to obtain C/N of the always optimal wobble signal, and a wobble servo will be stabilized more.

[0011] Said sampling generation circuit of the optical disk recording device concerning this invention The 1st delay element which carries out delay processing of said 1st sampling pulse preferably, The inverter which carries out the reversal process of said 1st sampling pulse, and the 2nd delay element which carries out delay processing of said 1st sampling pulse by which the reversal process was carried out, It comes to have the switch which changes the output from said 1st and 2nd delay elements, and outputs said 2nd sampling pulse, and the switching control circuit which controls the change of said switch accommodative based on a recording rate at least.
[0012]
[Embodiment of the Invention] Hereafter, with reference to an attached drawing, the optical disk record approach and equipment concerning the example of this invention are explained. Drawing 1 is the block diagram showing the basic configuration of some optical disk recording apparatus concerning one example of this invention. An optical disk 1 is an optical disk of the CD-R (Compact Disk-Recordable) mold with which pigment layers, such as cyanine dye, phtalo coloring matter, and diazo coloring matter, were formed on the transparence substrate of the polycarbonate in which the land and the groove were formed for example, at intervals of 1.6 micrometers. The rotation drive of this optical disk 1 is carried out by the constant linear velocity by the spindle motor 2. The optical pickup 3 is arranged in the recording surface of an optical disk 1, and the location which counters. Drive control of the optical pickup 3 is carried out by the delivery motor which is not illustrated radial [of an optical disk 1].
[0013] This optical pickup 3 builds a laser diode in the interior, and the light beam for record injected from this laser diode is irradiated by the recording surface on the land of an optical disk 1. Under the present circumstances, the reflected light reflected from the optical disk 1 is outputted from an optical pickup as a light-receiving signal S2, after light is received by the quadrisection photodetector of an optical pickup 3. The outputted light-receiving signal S2 is amplified with the HF amplifier 4, and is supplied to sample hold circuit 5for servoes a, and sample hold circuit 5b for wobble detection. Sample hold circuit 5a for servoes carries out sample hold of the predetermined period of the reflective signal S2 according to sampling pulse S3a outputted from the sampling pulse generation circuit 6. On the other hand, sample hold circuit 5b for wobble detection carries out sample hold of the predetermined period of the reflective signal S2 based on sampling pulse S3b which is changed accommodative and outputted with a recording rate from the sampling pulse generation circuit 6. The output of sample hold circuit 5a for servoes is given to the back servo circuit 9 by which was detected as a TE signal by the TE detecting element 7, and filtering was carried out with the low pass filter 8. The servo circuit 9 performs tracking control of an optical pickup 3 according to TE signal. Moreover, the output of sample hold circuit 5b for wobble detection is supplied to the wobble detector 10, and a wobble signal is detected here. Signal processing of the detected wobble signal is carried out in a signal-processing system (not shown), and required ATIP information is searched for.
[0014] On the other hand, the record signal S1 and the recording rate information TD which are outputted are supplied to the automatic laser power control (ALPC) circuit 11 from the record signal generation circuit (not shown), and the ALPC circuit 11 controls the laser power for recording the record signal S1 based on such information. In this example, in order to set the generating timing (location) and pulse width of sampling pulse S3a and S3b as an optimum value or to change sampling pulse S3b according to the class of optical disk 1 By the disk ID discrimination decision circuit 12, the recording rate scale factor of an optical disk 1, the class of

quality of the material, etc. are discriminated from Disk ID, and the generating location of sampling pulse S3a and S3b, and the decision of width of face and the change of sampling pulse S3b are performed based on this discernment result. Moreover, he is trying to control the generating location and width of face of a sampling pulse, laser power, etc. also by information, such as classification of the optical disk separately given from the exterior, and the recording rate information TD.

[0015] Drawing 2 is the block diagram showing a part of sampling pulse generation circuit 6 of this optical disk recording apparatus. The sampling pulse RP which reversed the record signal S1, the recording rate information TD, the disk ID information DI, etc. are inputted into this sampling pulse generation circuit 6. A sampling pulse RP is divided into what is inputted into delay element 14b after it is reversed through the thing and inverter 13 which are inputted into delay element 14a as it is, and is delayed by the predetermined time delay, respectively while it is supplied to sample hold circuit 5a for servoes as the 1st sampling pulse S3a. The sampling pulse RP delayed by delay elements 14a and 14b is outputted to a switch 15. On the other hand, it carries out accommodative so that it may say that it is inputted into the switching control circuit 16 which controls the change of a switch 15, the output from delay element 14a is used for the switching control circuit 16 based on such information when a recording rate is 4X about the change of a switch 15, and the recording rate information TD and the disk ID information DI use the output from delay element 14b at the time of 10X or more. The sampling pulse generation circuit 6 outputs sampling pulse S3b chosen by doing in this way to sample hold circuit 5b for wobble detection.

[0016] Drawing 3 is the wave form chart showing the record signal at the time of record of an optical disk 1, a light-receiving signal, and the sampling pulse for wobble detection, this drawing (a) shows the condition in a 1X recording rate, and this drawing (b) shows the condition in a 10X recording rate. In addition, falling of sampling pulse S3b is in agreement with the standup or falling of power-on of a record signal by a diagram. Although what is necessary is just to carry out the OR of each input signal of the delay elements 14a and 14b of drawing 2 in the AND gate in order to generate such pulse S3b, it is omitting in drawing 2 . Since the light-receiving signal S2 of the power-off period (lead section) of the record signal S1 is stable for a long time in the case of 1X as shown in this drawing (a), the light-receiving signal S2 of this period is sampled. For this reason, the switch 15 of the sampling generation circuit 6 chooses the output of delay element 14a. Therefore, it is delay element 14a, for example, only fixed time amount D1 delays the reversal signal which reversed the record signal S1, and the sampling pulse generation circuit 6 generates sampling pulse S3b for wobble detection, and outputs this to sample hold circuit 5b for wobble detection. Thereby, the period (sampling period) SP 1 corresponding to the period ST by which the light-receiving signal S2 from the standup of sampling pulse S3b for wobble detection to falling was stabilized can be sampled.

[0017] On the other hand, since the light-receiving signal S2 of the power-on period (Records Department) of the record signal S1 is stable from the power-off period (lead section) in the record actuation with a high recording rate as shown in this drawing (b), the light-receiving signal S2 of a power-on period is sampled. For this reason, the switch 15 of the sampling generation circuit 6 chooses the output of delay element 14b. By reversing further the reversal signal which reversed the record signal S1 through an inverter 13, inputting into delay element 14b, and delaying only fixed time amount D2, the sampling pulse generation circuit 6 generates sampling pulse S3b, and outputs it to sample hold circuit 5b for wobble detection. The record signal S1 sets up the sample ring period SP 2 from the standup of sampling pulse S3b for wobble detection to falling within the period of power-on (Records Department) by this. By making the comparatively flat period CST of the light-receiving signal S2 after the peak value of the light-receiving signal S2 passes within the period into the sampling period SP 2, since a long sampling time can be taken, C/N of a wobble signal can be made good.

[0018] In order to explain this in more detail, a light-receiving signal with a recording rate of 4X and a 12X light-receiving signal are expressed on the same time-axis in false to drawing 4 . Although C/N of a wobble signal is good if light-receiving signal S2a with a recording rate of 4X has the period ST by which the record signal S1 was stabilized within the period of power-off and that is sampled as shown in drawing 4 In light-receiving signal S2b with a recording rate of 12X, if fluctuation of the light-receiving signal level in the part is sharp and samples that temporarily, C/N of a wobble signal will get worse, and it will have great effect on a spindle servo etc. For example, when the level difference of light-receiving signal S2a in the stable period ST and S2b is set to Z1 in a plus direction and sets it to Z2 in the minus direction on the basis of light-receiving

signal S2a, even if it calculates it simply (Z1+Z2), it has a difference for +alpha, and sampling understands that it is not desirable. So, in this example, it is possible to make aggravation of C/N of a wobble signal into the minimum also at the time of a high recording rate by not daring use the place which hits at the period ST by which light-receiving signal S2a of light-receiving signal S2b was stabilized, but sampling using the comparatively flat period CST within the period (Records Department) of the power-on of the record signal S1.
[0019] In addition, this invention is not limited to the example mentioned above. For example, about the delay width of face D2 to the sampling initiation in the power-on period of a record signal, it is also effective to make it not set up not much greatly in order to use the return light part before the actual medium change by optical exposure arises taking advantage of the description of high-speed record. When considering as high-speed record more, as for the delay width of face D2, it is also effective to consider as zero substantially depending on the case.
[0020]
[Effect of the Invention] changing and using the sampling pulse for wobble detection according to the recording rate of an optical disk according to this invention, as stated above -- high twice -- a stenographic record -- the effectiveness that a wobble servo etc. is stabilized is done so so that a bad influence may not sometimes be done at wobble signal detection actuation.

[Translation done.]